Arch Clin Infect Dis. 2016 October; 11(4):e38813. doi: 10.5812/archcid.38813.

Published online 2016 August 7. **Research Article**

Distribution of *spa* Types, Integrons and Associated Gene Cassettes in *Staphylococcus aureus* Strains Isolated From Intensive Care Units of Hospitals in Tehran, Iran

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Received 2016 April 28; **Revised** 2016 July 08; **Accepted** 2016 July 17.

Abstract

Background: Nosocomial *Staphylococcus aureus* is known as an important clinical pathogen in health care, hospital, and community settings. One of the serious threats associated with clinical isolates of *Staphylococcus aureus* is multi-drug resistance associated with integrons.
Objectives: The objective of the present study was to investigate antimicrobial susceptibility patterns, frequency of class 1 and 2 integrons, and associated gene cassettes in different *spa* types of *Staphylococcus aureus* isolated from intensive care units (ICUs).
Methods: During a five-month descriptive cross-sectional study, 80 *Staphylococcus aureus* strains isolated from hospitalized patients in ICU wards in five hospitals of Tehran, Iran were investigated. *Staphylococcus aureus* isolates were submitted to susceptibility testing and Polymerase Chain Reaction (PCR) to detect *mecA* gene, class 1 and 2 integrons, and associated gene cassettes. All the isolates were genotyped by staphylococcal protein A (*spa*) typing.
Results: The overall prevalence of Methicillin-resistant *Staphylococcus aureus* (MRSA) was found to be 86.2%. All the isolates were susceptible to vancomycin, teicoplanin and linezolid and resistant to penicillin and ampicillin. All the 80 *Staphylococcus aureus* isolates were observed to be multi-drug resistant. Class 1 and 2 integrons were commonly found in 56.3% and 18.7% of the isolates, respectively. Six different gene cassettes were detected in class 1 integron (*aadA2*, *aadB*, *blaoxa*, *aacA4*, *cmlA6*, and *catB*) and three were found in class 2 (*dfrA1*, *aadA1*, and *sat2*). Gene cassette arrays *aadA*, *aadB*, *blaoxa*, and *aacA* were common in the two integron classes of *Staphylococcus aureus* isolates. Five different *spa* types of t790, t030, t969, t7580 and t1425 were identified among our isolates where *spa* type t790 was the most predominant *spa* type among integron-bearing *Staphylococcus aureus* strains.
Conclusions: The present study reports on a high rate of multi-drug resistance, the predominance of the frequency of class 1 integron, and the emergence of *spa* type t790 among Iranian *Staphylococcus aureus* strains. The results revealed that the dissemination of multi-drug resistance among *Staphylococcus aureus* isolates may be associated with the presence of integrons. Therefore, continuous surveillance to monitor integrons and the associated gene cassettes among nosocomial pathogens, especially *Staphylococcus aureus*, is essential.

Keywords: Integron, MRSA, *Staphylococcus aureus*

1. Background

Staphylococcus aureus (*S. aureus*) is the major cause of infection in either hospitals or within communities across the world (1) causing a variety of illnesses that can range from mild skin infections and wound infections to endocarditis, pneumonia, bacteremia and life-threatening diseases. *Staphylococcus aureus*, as one of the most prevalent pathogens in hospitals, can easily be transmitted by direct contact (including contaminated hands or droplet transmission) and indirect contact (such as environment or hospital air) between patients and medical staff (2). The most important factor contributing to the successful extensive distribution of this nosocomial pathogen is stated to be its remarkable ability to acquire resistance to new antimicrobial agents (3).

Shortly after the introduction of penicillin as a first therapeutic option for the treatment of infections caused by penicillin-resistant *S. aureus*, Methicillin-Resistant *Staphylococcus aureus* (MRSA) emerged in the 1960s, and